PATENT ABSTRACTS OF JAPAN

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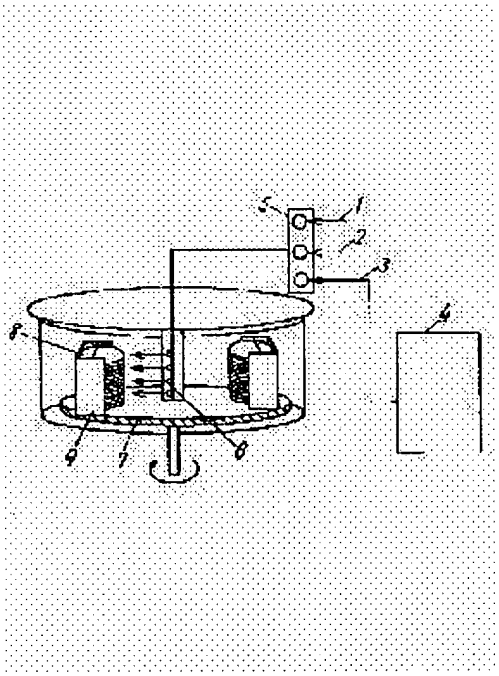
(54) WET ETCHING OF SEMICONDUCTOR SUBSTRATE

(57)Abstract:
PROBLEM TO BE SOLVED: To realize improvement in quality of a semiconductor device by eliminating etching irregularity and eliminating contamination due to cross contamination, in wet etching by spraying a treatment solution to an object on the surface of a substrate.
SOLUTION: A semiconductor substrate 8 on which a silicon oxide film with a thickness of 20nm is deposited is fixed on a rotary table 7. While the rotary table 7 is being rotated, an ozone solution 3 is sprayed to remove organic materials on the semiconductor substrate 8. Subsequently, a mixed solution of an etching solution 2 and the ozone solution 3 is sprayed from a spray nozzle 6, so as to etch the silicon oxide film on the semiconductor substrate 8. After etching, a manifold valve 5 for ultrapure water 1 is opened to spray the ultrapure water 1 from the spray nozzle 6, thereby rinsing the semiconductor substrate 8. After rinsing, the rotary table 7 is rotated at a high speed so as to dry the semiconductor substrate 8.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the wet etching approach of a semi-conductor substrate.
[0002]
[Description of the Prior Art] After the wet etching approach of the conventional semi-conductor substrate mainly etches into the etching reagent of a processing tub by immersing a semi-conductor substrate, it performs a rinse with a rinse tank and is dry after that with the centrifugal dryer. Moreover, the wet etching approach of a spraying type used in recent years etches by spraying an etching reagent, rotating a semi-conductor substrate, and dries with the rinse by pure water after that.
[0003]
[Problem(s) to be Solved by the Invention] However, by the wet etching approach by the processing tub that on the other hand the above-mentioned former is law, in order to process many semi-conductor substrates with the same etching reagent, there is a problem that contamination by cross contamination occurs. Moreover, since it etches by spraying an etching reagent, rotating a semi-conductor substrate by the wet etching approach by the spraying type, when the wettability of a processed material and processing liquid is bad, there is a problem that etching unevenness occurs.
[0004] This invention solves the above-mentioned conventional technical problem, does not have contamination by cross contamination, and makes it a technical problem to offer the wet etching approach which etching unevenness does not generate.
[0005]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the wet-etching approach of this invention sprays 0.1-20 ppm ozone water in advance of etching of a processed material, and washes a semi-conductor substrate front face in the wet-etching approach performed to the processed material on the front face of a substrate by spraying processing liquid, fixing to a rotation base the cassette which was made to rotate a semi-conductor substrate by single wafer processing at 100 or more rpm, or held the semi-conductor substrate, and rotating a rotation base by 50 or more rpm. Moreover, it etches by spraying processing liquid and the liquid which mixed ozone water.
[0006] With the aforementioned means, contamination by cross contamination is lost and etching unevenness is not generated.
[0007]
[Embodiment of the Invention] The organic substance on a semi-conductor substrate is removed by spraying 0.1-20 ppm ozone water on a semi-conductor substrate, rotating a semi-conductor substrate as mentioned above. If the organic substance has adhered on a semi-conductor substrate, since the organic substance will serve as a protective coat at the time of etching with processing liquid and etching unevenness will arise, ozone water removes the organic substance first.
[0008] By setting ozone water concentration to 0.1-20 ppm, the organic substance is effectively removable. In 0.1 ppm or less, the removal capacity of the organic substance has low ozone water concentration, the wettability improvement effect of a semi-conductor substrate front face is small, and in 20 ppm or more, ozone is spread outside and becomes unstable.

[0009] By fixing to a rotation base the cassette which was made to rotate a semi-conductor substrate by single wafer processing at 100 or more rpm, or held the semi-conductor substrate, and rotating a rotation base by 50 or more rpm, the organic substance on a substrate front face can be removed in a short time, and the wettability of the processed film and etching-reagent ** can be improved.
[0010] Moreover, by spraying processing liquid and the liquid which mixed ozone water on a semi-conductor substrate, a semi-conductor substrate front face is oxidized with ozone water, wettability is improved, since it etches with processing liquid, etching unevenness is lost, and the silicon oxide on a semi-conductor substrate can be etched into homogeneity.
[0011] Moreover, contamination by cross contamination can be lost by spraying and etching continuously new liquid into a semi-conductor substrate.
[0012] Next, in the process which etches the silicon oxide or the silicon nitride on a semi-conductor substrate, an example of the concrete wet etching approach of this invention is explained using a drawing.
[0013] Drawing 1 is the schematic diagram of the etching system used in this example. the etching reagent of fluoric acid with which 1 was diluted by ultrapure water and 2 was diluted by the ratio of 15:1 in drawing 1 , and 3 -- for a manifold valve and 6, as for a rotation base and 8, a spraying nozzle and 7 are [ozone water and 4 / ozone water generation equipment and 5 / a semi-conductor substrate and 9] cassettes.
[0014] As shown in drawing 1 , the semi-conductor substrate 8 which put silicon oxide on the top face as processed film at the thickness of 20nm is set to a cassette 9, it fixes to the rotation base 7, and this rotation base 7 is rotated with the rotational speed of 50 or more rpm. Rotating the rotation base 7, a manifold valve 5 is opened and ozone water 3 with a concentration of 0.1-20 ppm generated with ozone water generation equipment 4 is sprayed at above rate by 100ml/from a spraying nozzle 6. By spraying ozone water 3, rotating the rotation base 7, the organic substance on the semi-conductor substrate 8 is washed. By rotating the rotation base 7 by 50 or more rpm, the organic substance on the front face of the semi-conductor substrate 8 can be removed in a short time, and the wettability of the processed film and an etching reagent can be improved.
[0015] The manifold valve 5 of an etching reagent 2 is opened succeeding this, the etching reagent 2 held in temperature of 20 degrees C is sprayed for 2 minutes from a spraying nozzle 6, and the silicon oxide on the semi-conductor substrate 8 is etched.
[0016] After etching, the manifold valve 5 of ultrapure water 1 is opened, ultrapure water 1 is sprayed from a spraying nozzle 6, and the rinse of the semi-conductor substrate 8 is carried out. After a rinse, the rotation base 7 is rotated at high speed, and the semi-conductor substrate 8 is dried.
[0017] Etching removal of the silicon oxide which is processed film was carried out at homogeneity from the front face of the semi-conductor substrate 8 etched as mentioned above, and the smooth silicon side was acquired.
[0018] Other examples of the gestalt of operation of this invention are explained below, referring to drawing 1 . The semi-conductor substrate 8 which put silicon oxide on the top face as processed film at the thickness of 20nm is set to a cassette 9, it fixes to the rotation base 7, and this rotation base 7 is rotated with the rotational speed of 50 or more rpm. Rotating the rotation base 7, the mixed liquor of the ozone water 3 with a concentration of 0.1-20 ppm and the etching reagent 2 which were generated with ozone generation equipment 4 is sprayed for 2 minutes from a spraying nozzle 6, and the silicon oxide on the semi-conductor substrate 8 is etched. By rotating the rotation base 7 by 50 or more rpm, the wettability of the processed film on the front face of the semi-conductor substrate 8 and an etching reagent can be improved, and it can etch into homogeneity. The manifold valve 5 of ultrapure water 1 is opened after etching, ultrapure water 1 is sprayed from a spraying nozzle 6, and the rinse of the semi-conductor substrate 8 is carried out. After a rinse, the rotation base 7 is rotated at high speed, and the semi-conductor substrate 8 is dried.
[0019] From the front face of the semi-conductor substrate 8 etched as mentioned above, etching removal of the silicon oxide which is processed film was carried out at homogeneity.
[0020] The example of further others of the gestalt of operation of this invention is explained below, referring to drawing 1 . The semi-conductor substrate 8 which put silicon oxide on the top face as processed film at the thickness of 20nm is set to a cassette 9, it fixes to the rotation base 7, and this rotation base 7 is rotated with the rotational speed of 50 or more rpm. A manifold valve 5 is sprayed for ozone water 3 with a concentration

of 0.1-20 ppm generated with ozone water generation equipment 4 at above rate by 100ml/from **** and ********** 6, rotating the rotation base 7. spraying ozone water 3, rotating the rotation base 7 -- the organic substance on the semi-conductor substrate 8 is washed.

[0021] The manifold valve 5 of an etching reagent 2 and ozone water 3 is opened succeeding this, the mixed liquor of the etching reagent 2 and the ozone water 3 which were held in temperature of 20 degrees C is sprayed for 2 minutes from a spraying nozzle 6, and the silicon oxide on the semi-conductor substrate 8 is etched.

[0022] After etching, the manifold valve 5 of ultrapure water 1 is opened, ultrapure water 1 is sprayed from a spraying nozzle 6, and the rinse of the semi-conductor substrate 8 is carried out. After a rinse, the rotation base 7 is rotated at high speed, and the semi-conductor substrate 8 is dried.

[0023] After ozone water removed the organic substance as mentioned above, by processing with the mixed liquor of ozone water and an etching reagent continuously, etching removal of the silicon oxide which is processed film was further carried out from the front face of the semi-conductor substrate 8 at homogeneity, the smooth silicon side was acquired and the movable ion consistency which remains on a front face was able to be set to two or less 2.5x1010-/cm.

[0024] The example of further others of the gestalt of operation of this invention is explained referring to drawing 2 . Drawing 2 is the schematic diagram of the etching system used in this example. For ozone water and 4, as for a manifold valve and 6, in drawing 2 , ozone water generation equipment and 5 are [the etching reagent of fluoric acid with which 1 was diluted by ultrapure water and 2 was diluted by 15:1, and 3 / a spraying nozzle and 8] semi-conductor substrates. A different place from the example shown in drawing 1 is having made rotation of a semi-conductor substrate into single wafer processing.

[0025] As shown in drawing 2 , the semi-conductor substrate 8 which put silicon oxide on the top face as processed film at the thickness of 20nm is rotated with the rotational speed of 100 or more rpm by single wafer processing. Rotating the semi-conductor substrate 8, a manifold valve 5 is opened and ozone water 3 with a concentration of 0.1-20 ppm generated with ozone water generation equipment 4 is sprayed at above rate by 10ml/from a spraying nozzle 6. By spraying ozone water 3, the organic substance on the semi-conductor substrate 8 is washed. By rotating the semi-conductor substrate 8 by single wafer processing at 100 or more rpm, the organic substance on a substrate front face can be removed in a short time, and the wettability of the processed film and an etching reagent can be improved.

[0026] The manifold valve 5 of an etching reagent 2 is opened succeeding this, the etching reagent 2 held in temperature of 20 degrees C is sprayed for 2 minutes from a spraying nozzle 6, and the silicon oxide on the semi-conductor substrate 8 is etched. After etching, the manifold valve 5 of ultrapure water 1 is opened, ultrapure water 1 is sprayed from a spraying nozzle 6, and the rinse of the semi-conductor substrate 8 is carried out. After a rinse, the semi-conductor substrate 8 is rotated at high speed, and the semi-conductor substrate 8 is dried.

[0027] After ozone water removed the organic substance as mentioned above, by processing with an etching reagent continuously, etching removal of the silicon oxide which is processed film was carried out from the front face of the semi-conductor substrate 8 at homogeneity, and the smooth silicon side was acquired.

[0028] In addition, although ozone water was sprayed in advance of etching of a processed material and the semi-conductor substrate front face was washed in this example, processing liquid and the liquid which mixed ozone water may be sprayed, and a processed material may be etched.

[0029]

[Effect of the Invention] Since according to the wet etching approach of this invention etching unevenness is abolished, good etch uniformity is obtained upwards by ozone water's washing a semi-conductor substrate first, and etching with etching reagents, such as fluoric acid, and the mixed liquor of ozone water succeedingly and contamination by cross contamination can be lost, greatest effectiveness can be raised to upgrading of a semi-conductor, and improvement in the yield.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] The schematic diagram of an example of the etching system used by the etching approach of the semi-conductor of this invention
[Drawing 2] The schematic diagram of other same examples
[Description of Notations]
1 Ultrapure Water
2 Etching Reagent
3 Ozone Water
4 Ozone Water Generation Equipment
5 Manifold Valve
6 Spraying Nozzle
7 Rotation Base
8 Semi-conductor Substrate
9 Cassette

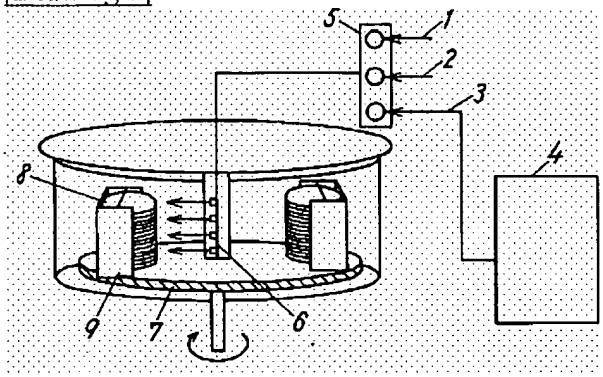
[Translation done.]

* NOTICES *

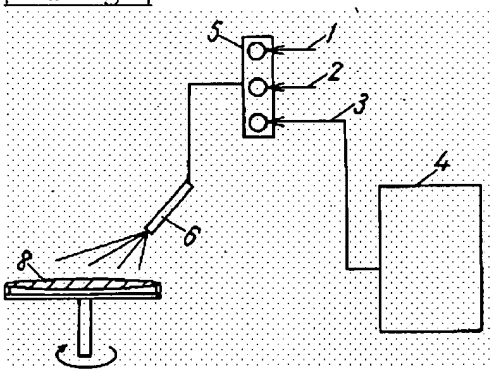
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Drawing 2]



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